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Apparatus for Spray Coating Articles

We, HARPER J. RANSBURG, HARPER GREGG RANSBURG, HAROLD PRESTON RANSBURG and EDWIN MARLIN RANSBURG, all citizens of the United States of America, trading as HARPER J. RANSBURG COMPANY, of No. 1234, Barth Avenue, Indianapolis, Indiana, United States of America, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to an apparatus for spray coating articles in an electrostatic spray field such as to electrically attract the coating material to the article or articles to be coated, and wherein the coating is discharged into such field for such purpose by a spray gun.

This invention is more particularly directed to safety equipment and control apparatus for hand spraying in an electrostatic field, wherein the spray gun may be grasped and manipulated by an operator to direct the spray over and about the article being coated while moving the gun to different positions relative thereto and over extended surfaces thereof.

Such manual manipulation of the spray gun by an operator is advantageous in coating articles of different sizes or configurations, or articles of peculiar shapes. Thus under such conditions the position of the gun relative to the article, or the direction of the spray, may be changed according to the surface characteristics of the article or group of articles passing through the spray booth, and may be manipulated to properly coat surfaces which a fixed gun may not serve.

It is therefore the purpose of this invention to provide a control and safety apparatus such as to permit the usual manual operation of the spray gun by the operator while spraying into an electrostatic field. In this connection the principal requirement is that of safety, since the voltage required is of such high potential as to make it extremely dangerous for the manual manipulation of the spray gun unless the operator is surrounded by protective safeguards. It is also essential that provision be made to maintain a

proper distance or gap between the discharge electrode and the article being coated, since they are of high potential difference. It is further desirable that the apparatus so maintain the juxtaposition of the gun and the electrode as to cause the spray to be discharged from without the electrostatic field, and wherein the gun and electrode may be of different potential, maintain sufficient gap between them for safety.

With this arrangement the flexibility of hand spray is combined with the economy of electrostatic coating, a highly desirable combination in the coating of articles which are not repetitive in shape and color. Thus the human control is introduced into electrostatic coating wherein it may be difficult to coat articles by the fully automatic or fixed spray guns.

The various features of the invention such as to obtain the above described advantages will be more particularly set forth and described in the following description and accompanying drawings.

The full nature of the invention will be understood from the accompanying drawings and the following description and claims:

Fig. 1 is a perspective view of one form of apparatus embodying the invention.

Fig. 2 is a wiring diagram in connection with the apparatus of Fig. 1.

Fig. 3 is a perspective view showing a modified form of the invention.

Fig. 4 is a wiring diagram of the apparatus shown in Fig. 3.

Fig. 5 is an illustrative view of a mounting for the spray gun and electrode of modified form.

Fig. 6 is a similar view to Fig. 5 showing a further modified form.

In the drawings there is illustrated an electrostatic spray equipment including an overload conveyor track along which the carriers are caused to slowly travel for conveying the articles to a position for establishing an electrostatic field for spray coating the surface thereof. Suitable means may be provided for slowly rotating the articles as they pass through the field wherein it may be

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desired to spray coat the several surfaces thereof, such as by a rack bar 13 engageable by pinions 14 on the carriers.

Adjacent the line of travel of the articles and spaced therefrom there is an adjustable protective cage for the operator indicated at 15, said cage including opposed fixed frame supports 16 and an adjustable operating frame 17. The operating frame is carried on the horizontal supporting bars 18 slidably supported within the horizontal tubular bars of the frame 16, whereby the operating frame may be adjustably positioned in predetermined spaced relation to the line of travel of the articles to be coated. The operating frame 17 is provided with a pair of upright slide bars 17a at opposite ends of the electrostatic field throughout which the operator may direct the spraying operation.

Slidably mounted upon the upright slide bars 17a there is a horizontal control bar 19 which carries with it the forwardly extending insulating bars 20. Said bars carry on their forward ends the discharge electrode wires 21 which are electrically connected to a source of high voltage 22 through an insulated conductor 23 and a coil spring conductor 24, which latter provides a resilient connection to permit the control bar 19 to slide on the vertical members 17a of the frame 17.

The manually operated spray gun 25 is slidably supported on the control bar 19 by a ring 26 with which it is swivelly connected, whereby said gun may be manually directed in any direction and bodily moved lengthwise of the bar 19 within the cage, and further, whereby said gun is at all times restrained from too close an approach to the electrode. The gun is connected by suitable flexible hose to the supply of coating and the supply of air in the usual manner.

The control bar 19 has its weight counterbalanced by a suitable tension spring within the spring pulley 27 carried upon the cage, through the supporting cables 28 having their ends connected to the bar. This permits the operator to readily and conveniently move the bar with the gun up and down within the lower and upper confines of the operating frame on the cage. The operating frame may also be preliminarily adjusted to position the electrode in proper spaced relation to the line of travel of the articles and there locked by the lock screws 29. Thus wherein the adjacent sides of the articles to be coated move along the same plane, the operator is assured that the spacing between the articles and the electrode will be correctly arranged and fixed, while he will be permitted to direct

the spray in any direction and move the gun laterally or vertically to cover the full surface of the articles. Wherein the surface of the articles conveyed through the field may vary within limits, the set screw 29 may be freed and a stop collar 30 may be secured to the supporting bar 18 limited in its movement by the frame support 16 and a limit bracket 31. This will permit the operator to move the electrode 21 to and from the articles within safe limits to maintain proper spacing with respect to different articles passing through the field.

In order that no article may pass through the field with a projection or bulge which would bring it too close to the electrode, the operating frame carries an extension forwardly of the field which supports a photo-electric cell 32 and a light source 33 on opposite sides of the line of travel of the articles. The direct line between the cell and source is so related to the extended plane of the electrode as to prevent operation of the system if any article passes through the line such as to break the beam of light. Thus the operator may be assured that if some article comes along the conveyor such as to too closely approach the plane of the electrode, the circuit therethrough will be broken. Also, to insure opening of the circuit should the operator leave his position, and to permit him to quickly and conveniently open the circuit through the electrode if any difficulty arises, there is provided a hand-pull switch cord 34 which he must grasp with his free hand and pull down in order to close the circuit control switch 35. Upon his release of the pull cord, the circuit through the electrode will be broken.

In this system, as shown in the wiring diagram of Fig. 2, the operator, cage, articles to be coated, and spray gun are grounded, whereas with the circuit closed the electrode is at a high potential. Upon operation of the control circuit when closed by the photo-electric barrier relay 36, as well as the pull cord switch 35 and the switch 37 on the spray gun, 110 volts will be supplied through the line 38 to the control relay 39. The relay 39 upon thus being energized closes and energizes with 220 volts the primary circuit of the high voltage source 22. This in turn induces voltage in the secondary circuit composed in series of ground 40, transformer secondary 41, and rectifying tube 42. This causes high voltage current to pass through the connector line 23, spring 24, electrode 21, and through the field to the articles 12 and 12a, conveyor track 10 to ground 43. Thus the electrostatic field is established between the electrode and

the article to be coated within which the coating is sprayed by the spray gun for electrical precipitation upon the article.

In the above described system the operator and the gun are grounded, whereas the electrode is charged at high voltage. A similar system may be provided having substantially the same advantages, but wherein the operator as well as the gun are of the same potential as the electrode. In this arrangement the electrode may be carried directly upon the gun. With the electrode carried by the gun some additional flexibility in operation is permitted such as to enable the operator to move the gun and electrode above and below the article to coat the top and bottom thereof as more particularly illustrated in Figs. 5 and 6.

Thus, in the modified form of the invention as is shown in Figs. 3 and 4, like numbers represent like parts as above described, the track rail 10 with the articles to be coated carried thereby being grounded as indicated at 43. However, as distinguished from the apparatus shown in Figs. 1 and 2, the operator 15, the spray gun 25 and the entire protective cage structure are maintained at the same high potential as the electrode 121 and enables the electrode to be mounted directly upon and carried by the gun but supported forwardly thereof in spaced relation. The protective cage including the control bar 10 prevents the electrode carried by the gun from approaching too closely to the articles. However, the plane of movement of the gun with the electrode mounted thereon may be adjusted with respect to the plane of travel of the articles by the adjustment of the operating frame 17, 18 in respect to the supporting frame 16 in the manner before mentioned.

In order that the operator will be protected from being grounded while at such high potential, a switch control plate 122 is provided upon which he must stand in order to close the circuit during operation. Due to the insulated supporting platform 123 carried by insulators 124, he cannot step to ground without leaving the switch control plate 122 and thereby break the circuit. Also, in this arrangement it is required that the supply tube 126 from the air source shall not provide an electrical path to ground. Therefore, the flexible tubing to the gun is directly connected with a tank 125 which contains a coating material, said tank being supported upon the insulated platform 123 and only connected with a source of air pressure through a flexible tube 126 of insulating material.

In this form of the invention, as long

as the operator is on plate 122, has one hand engaged with the gun and closes switch 37 thereon, and the other hand resting on the switch cord 34 to close switch 35, an electrostatic field is produced in the space between the electrode 121 and the articles to be coated. However, the operator cannot leave the platform without breaking the circuit through one or more of the several switches 35, 37 or 122, and he cannot ground himself while in position to close said switches.

As shown in Fig. 5 the control bar 19 carrying the gun 25 with the electrode 121 thereon as in Fig. 3, may be mounted to slide up and down upon a curved operating frame 217. Or, as shown in Fig. 6, a semicircular operating frame 317 may be employed about which the gun and electrode may move. The curved or semicircular operating frames may be in the form of attachments to be secured to the straight upright operating frames 17 of Figs. 1 and 3. With such arrangement, either the electrode 121 carried by the gun at high potential or the electrode 21 carried by insulating bars 20 upon the control bar 19 may be used, the gun being grounded.

By means of the curved or semicircular operating plane, the operator may more conveniently move the gun and electrode into position for coating the upper or lower ends or surfaces of the articles passing through the spray zone.

The articles to be coated are herein shown as in effect comprising a collecting electrode or terminal for the circuit including the source of high voltage for producing a high potential difference between the discharge electrode and the articles. Wherein such articles may be of non-conductive material, they may be mounted on or supported by a metal conductor which in effect results in the high potential difference being produced between the discharge electrode and the non-conducting article. For that purpose such conductor support is herein considered to constitute a part of the article during its passage through the spray zone.

Also, whereas the invention in its several modifications has been described in detail for illustrative purposes, it is to be understood that the circuit may be revised so that the discharge electrode is grounded and the articles or their supports comprise a collecting electrode at high electric potential, or so that the discharge electrode and the articles to be coated or their supports are each at a high electric potential of different polarity.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to

be performed, we declare that what we claim is:—

1. Apparatus for permitting an operator to manually spray coat articles in an electrostatic field, wherein the operator is protected by a protective structure and a movable support is provided for a spray gun and one of the electrodes providing the electrostatic field, to permit the manual shifting thereof to different positions relative to the articles within limits permitted by said structure, the electrostatic field being produced by the articles or their support and a discharge electrode constituting opposed terminals in an electric circuit including a source to produce a high potential difference therebetween.

2. Apparatus as claimed in Claim 1 wherein the movable support comprises a control bar slidably mounted on said structure for permitting movement thereof in predetermined spaced relation to the surface to be coated, and the spray gun is mounted thereon for universal movement.

3. Apparatus as claimed in Claim 1 wherein means is provided for continuously moving the articles past said protective structure for successively bringing them into such relation to the discharge electrode as to create the electrostatic field therebetween and within effective range of the spray gun.

4. Apparatus as claimed in Claim 1 wherein a normally closed switch is provided in a circuit having control means extending adjacent the path of movement of the articles adapted to be operated by an article too closely approaching the discharge electrode to open the circuit.

5. Apparatus as claimed in Claim 1 wherein the circuit includes a pair of normally open control switches, one mounted on the gun and the other on the

protective structure, each of said switches to be manually closed by the operator when he is in operating position.

6. Apparatus as claimed in Claim 4 wherein the normally closed switch is actuated by a light sensitive control element in turn actuated by a light beam which an article will interrupt if it passes when too close to the discharge electrode for opening the switch and breaking the circuit.

7. Apparatus as claimed in Claim 1 wherein the electrostatic field is produced by the articles or their support and the discharge electrode comprising opposed terminals in an electric circuit including a source to produce high potential difference therebetween and wherein said gun may be outside of said field.

8. Apparatus as claimed in Claim 1 for permitting an operator to manually spray coat articles in an electrostatic field, wherein the operator is protected by protective structure and a movable support is provided for permitting manipulation of a spray gun within limits permitted by said structure, and wherein the electrostatic field is produced by a discharge electrode carried by said gun, the articles or their support and the discharge electrode comprising opposed terminals in an electric circuit including a source to produce a high potential difference therebetween, the gun being movable to permit the operator to direct the spray into said field for deposition of the coating material on the article.

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148—150, Holborn, London, E.C.1,
Agents for the Applicants.

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FIG. 1

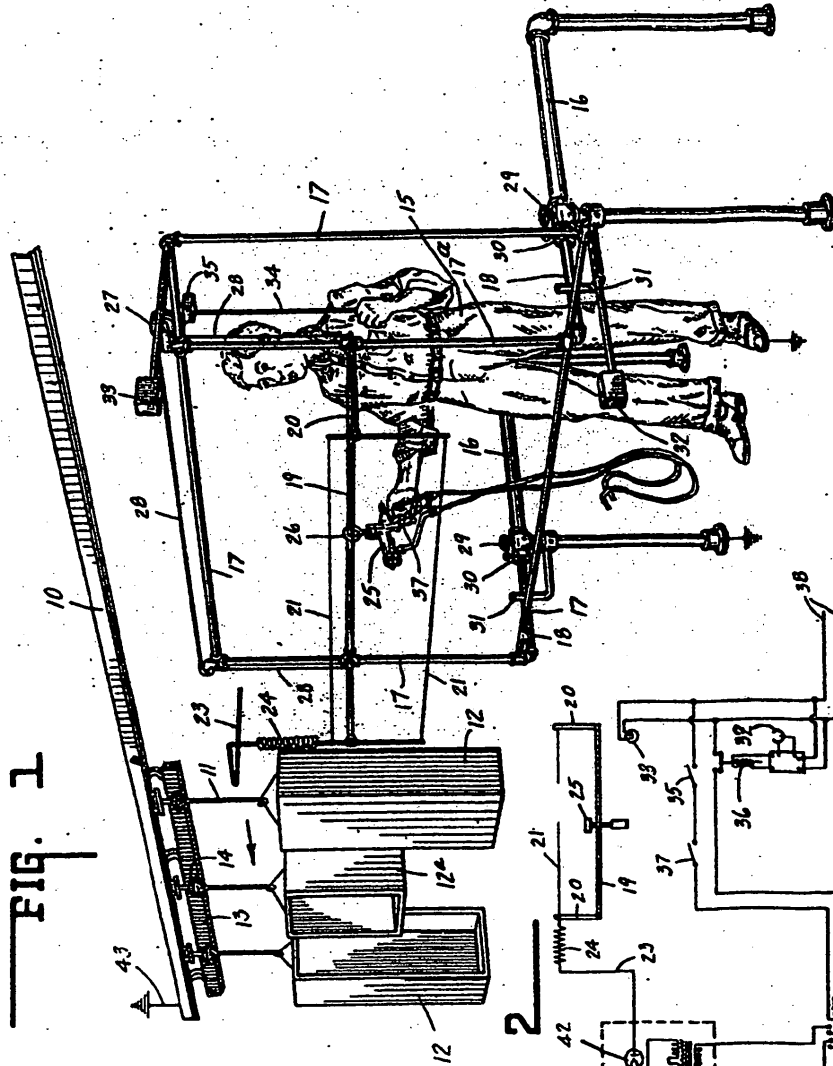
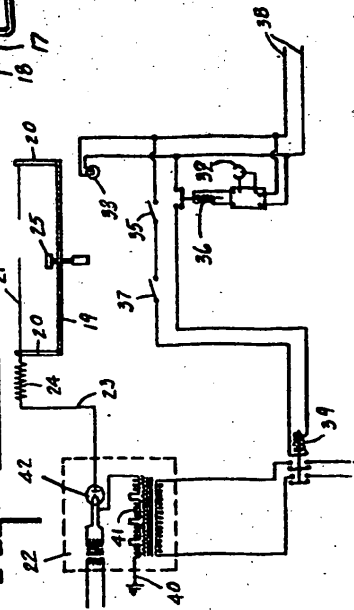


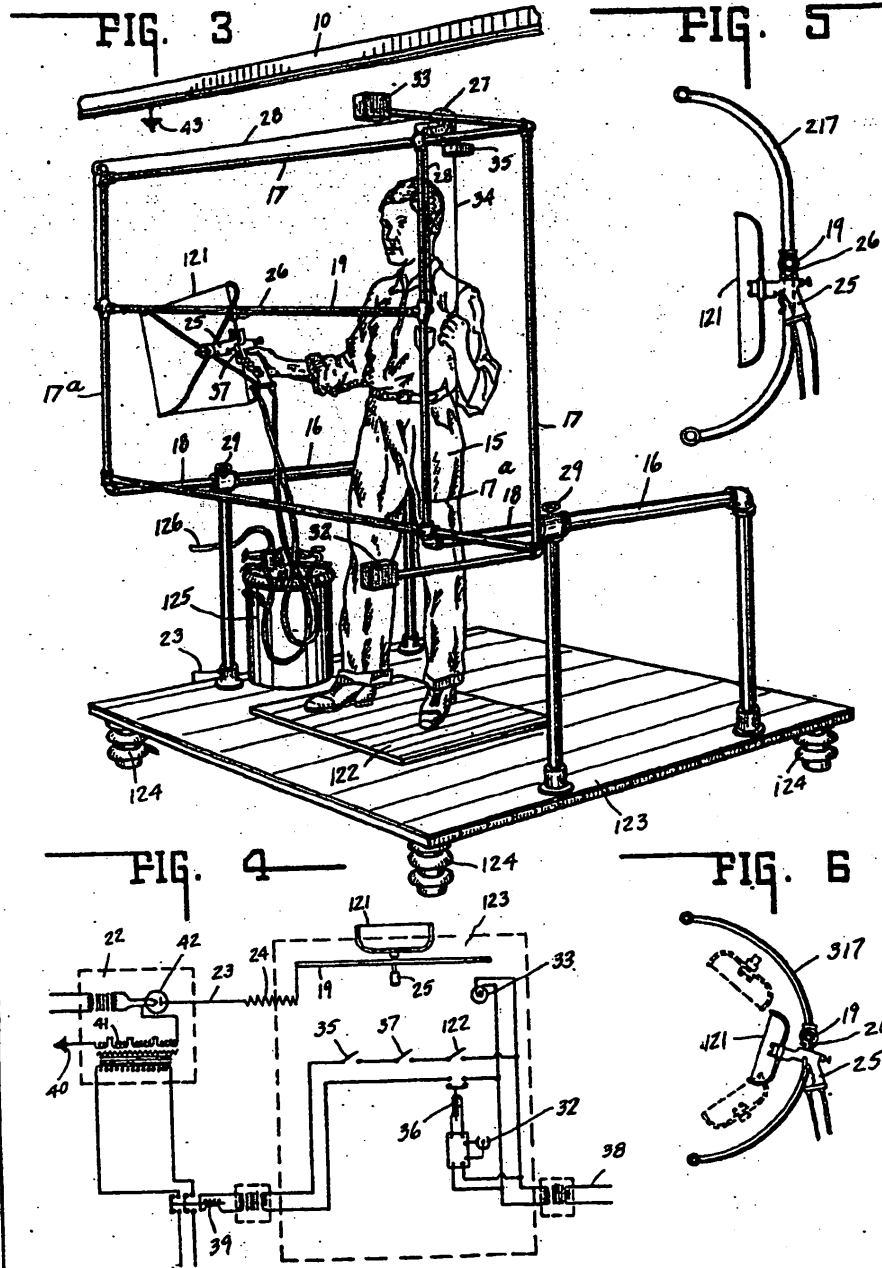
FIG. 2



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